

Pressure Induced Magnetic Phase Transitions

Beamline: X25

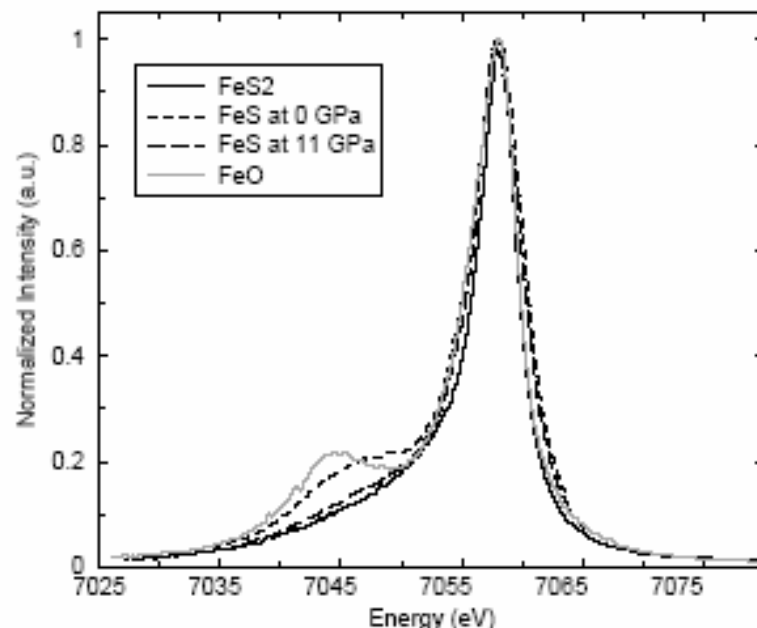
Technique: X-ray
Emission Spectroscopy
(XES)

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Motivation: High energy scale charge fluctuations, such as on-site Coulomb interaction and ligand-to-metal charge transfer energy are important in the understanding of the diverse properties of transition metal compounds. High-pressure, as an experimental variable, provides a unique way to systematically introduce large perturbations of these parameters into the system. Hence, it is of interest to study the high-pressure behavior of transition metal compounds.

Results: We developed a new technique to study high-resolution x-ray emission spectra for materials under high pressure. It allows us to observe a pressure-induced high-spin to low-spin transition in FeS. The transition is evidenced by the disappearance of the low-energy satellite in the Fe K β emission spectrum of FeS. Moreover, the phase transition is reversible and closely related to the structural phase transition from a manganese Phosphide-like phase to a monoclinic phase.



XES spectra of FeS in the high-spin (ambient), low-spin (11.5 GPa) states, along with reference spectra of two iron compounds, FeO (high-spin) and FeS2 (low-spin).